

PLEISTOCENE MOLLUSCS FROM THE WEST AND SOUTH COASTS OF THE CAPE PROVINCE, SOUTH AFRICA

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(With 22 figures)

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ABSTRACT

Nineteen species of Pleistocene to Recent littoral molluscs are discussed, belonging to the families Trochidae, Stomatidae, Potamididae, Cerithiidae, Calyptraeidae, Buccinidae, Terebridae, Acteonidae, Nuculanidae, Ungulinidae, Lucinidae, Veneridae, Petricolidae, Donacidae and Tellinidae. New species and subspecies are described for the genera *Cerithidea* (*Cerithidea*), *Crepidula capensis* (subsp. nov.), *Triumphis*, *Duplicaria*, *Pupa* (*Strigopupa*), *Petricola* (*Claudiconcha*), *Donax*, *Gastrana*. New synonyms, new combinations, new records, and cases of revised status are discussed. These include *Cantharidus suarezensis suarezensis* (Fischer, 1878), *C. s. fultoni* (Sowerby, 1889), *Pseudostomatella orbiculata* (A. Adams, 1850), *Cerithium scabridum rufonodulosum* E. A. Smith, 1901, *Nuculana* (*Lembulus*) *bicuspidata* (Gould, 1845), *Felania diaphana* (Gmelin, 1791), *Loripes* (*Microloripes*) *liratula* (Sowerby, 1889), *Venerupis dura* (Gmelin, 1791), *Macoma* (*Heteromacoma*) *tricostata* (Römer, 1872), *Leporimetis* (*Leporimetis*) *hanleyi* (Dunker, 1853).

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INTRODUCTION

Numerous exposures of Pleistocene marine sediments are preserved on the wave-cut platforms adjacent to the present South African coast, and in estuaries and lagoons. Radio-carbon measurements show that these deposits are beyond the range of the ^{14}C dating technique (Tankard, in press). Generally the Pleistocene faunas of the South African coastlands are poorly known. More than 160 species of invertebrate fossils have so far been identified in this project.

The west and south coasts of the Cape Province have been tectonically

unstable in the Tertiary and possibly through the Early and Middle Pleistocene. Between Cape Town and St Helena Bay (Fig. 1) Neogene marine sediments are found at lower elevations than their chronostratigraphic equivalents on the Cape south coast, or the South West African coast. Furthermore, between Cape Town and St Helena Bay the highest observed Pleistocene beach deposits are at 10 m a.s.l. (above mean sea level) (Tankard, in press). Carrington & Kensley (1969) record a series of transgressive complexes up to 90 m a.s.l. on the Namaqualand coast, while Davies (1971) has identified Pleistocene raised beaches at 60 m a.s.l. on the south coast. We envisage that intermittent sagging took place in the area between the Olifants River and the Cape Peninsula throughout most of the Cenozoic.

In the Saldanha–Langebaan area there are several exposures of Early Pleistocene shelly sands. Just north of Langebaan (1,5 km) in a shallow quarry at 9,5 m a.s.l. there is a shelly deposit overlying Tertiary limestone. The fauna is characterized by *Fissurella robusta* Sowerby, *Cerithidea* sp. nov., *Triumphis* sp. nov., *Purpura praecingulata* (Haughton), *Petricola* sp. nov., and large *Perna perna* (Linnaeus) (= *Mytilus tomlini* Haughton). Similar deposits are exposed on either side of the Hoedjiespunt peninsula where they lie either directly on a quartz porphyry platform or on Miocene phosphorite. Behind the Sea Harvest factory on the Hoedjiespunt peninsula the littoral deposit includes wave-generated beach boulders. Here the horizon is exposed up to 8 m a.s.l. and is composed largely of *Patella* spp., although *Fissurella robusta*, *Petricola* sp. nov., and large *Perna perna* (Linnaeus) are common. These deposits are assigned to the Early Pleistocene, rather than the Late Pleistocene, because the mollusc fauna is more primitive than any of the Late Pleistocene sites so far examined, and does not contain any of the warm-water fauna that characterizes deposits from other Late Pleistocene embayments and estuaries and is poorly preserved when compared with these younger deposits.

Generally the mollusc fauna from the Early Pleistocene sites at Saldanha and Langebaan is near-shore in character. At the Langebaan site the barnacle *Balanus amphitrite* Darwin encrusts the Tertiary limestone. *B. amphitrite* is today an inhabitant of the lower intertidal to infratidal zones. This would imply that the strand line should really be recorded at about 10 m a.s.l.

The mollusc fauna, particularly *Fissurella robusta*, *Triumphis* sp. nov., *Purpura praecingulata*, large *Perna perna*, and *Petricola* sp. nov. suggests correlation with Haughton's (1932) Zone-D of the Namaqualand coast, and the 45–50 m transgression complex of Carrington & Kensley (1969). If this correlation is correct the 10 m shoreline in the Langebaan–Saldanha area would be of Early Pleistocene age.

In contrast, extensive Late Pleistocene beach deposits occur up to 7,0 m a.s.l. on the west coast (e.g. Velddrif) and 7,2 m a.s.l. on the south coast (e.g. Coega River mouth). The mollusc faunas that characterize these beach deposits have a distinctly modern aspect and are identical with the present and adjacent open-coast faunas. But preserved in Pleistocene estuarine and lagoonal deposits are

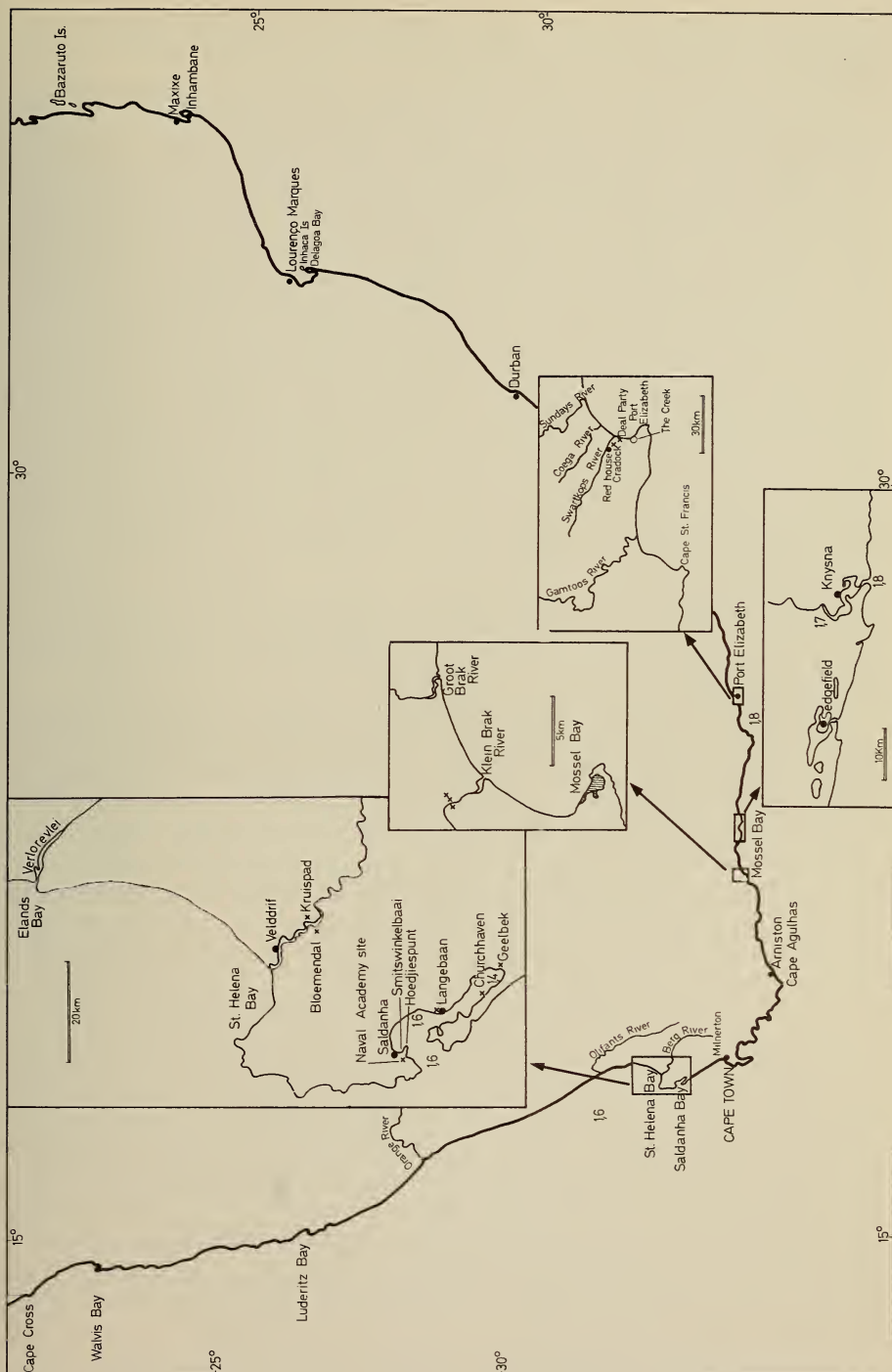


Fig. 1. Locality map. Numerals along the coastline and in estuaries refer to present tidal range in metres.

thermally anomalous fossil mollusc faunas. The intertidal molluscs and ostracods all suggest a 6,5 m strandline.

The most characteristic feature of the fossil molluscs from the lagoonal and estuarine facies is that they constitute mixed cool-water/warm-water assemblages. This mixed assemblage of taxa with mutually exclusive modern geographic ranges is characterized by populations of warm-water molluscs that existed in the last interglacial far south of their known present day geographic range end-points. The cool-water element is similar to that of present day open-coast faunas. The occurrence of the warm-water molluscs in the sheltered environments is probably the result of a brief extension of their southerly range during a relatively warmer part of the marine climatic cycle. Only in the sheltered environments of the estuaries, far removed from the effect of cold oceanic circulation, were the warm-water taxa able to establish reproductive populations. Higher water temperatures than at present found in these sheltered environments was probably the result of increased solar radiation (Tankard 1975). We believe that this warm period coincides with the well documented period of higher palaeotemperature at 120 000 B.P., the substage 5e of Shackleton (1969) and Shackleton & Opdyke (1973).

In the present paper the taxonomy of a number of problematical molluscs, encountered during studies on Pleistocene deposits, are discussed. While some have proved to be referable to species still extant elsewhere, several are clearly undescribed species.

Throughout this study height above sea level (a.s.l.) is referred to mean sea level. Tidal ranges are shown in Figure 1. In the following text Natal Museum has been abbreviated to N.M. and South African Museum to S.A.M. Where possible, the elevation of sample localities is listed.

SYSTEMATIC DESCRIPTIONS

Class GASTROPODA

Family Trochidae

Cantharidus (Jujubinus) suarezensis (Fischer, 1878)

In analysing the systematics of this species, five names must be considered:

(1) *Trochus suarezensis* Fischer, 1878. This trochid appears to have remained unknown to English workers, even though Dautzenberg (1929) implied it to be a common Malagasy species. This is evidently the result of an error in Pilsbry's 1889 translation of Fischer's description, to which Dr Harald Rehder has kindly drawn our attention. The word 'geminatis' ('twinned') of the original description was evidently misread as 'gemmatis', which was rendered as 'slightly granose' in Pilsbry's text, and 'distinctly granose' in his comments. As a consequence the number of spiral lirae was also incorrectly cited, the duplication of these producing a total of twelve in the type, instead of only seven.

(2) *Trochus fultoni* Sowerby, 1889. Although this name appears in Sowerby's

text, in the caption to his original plate he used the name *Trochus stenomphalus*. Tomlin (1931: 419), acting as first reviser, selected *T. fultoni* as senior synonym. This name was based on supposedly recent shells from Port Elizabeth. However, like a number of other species described from there (e.g. *Monilea ponsonbyi* (Sowerby, 1888), *Loripes liratula* (Sowerby, 1889) and *Cerithium scabridum rufonodulosum* E. A. Smith, 1901), it does not appear to live in that region, and the type material may be presumed to have been derived from a raised beach. To this day specimens of most of these species, including '*T.*' *fultoni*, are often washed up on the shore on either side of the mouth of the Swartkops River, which is here designated as the restricted type locality for '*T.*' *fultoni*.

(3) *Calliostoma farquhari* Sowerby, 1892. While this was described as coming from Port Elizabeth, a note has been left by H. C. Burnup to the effect that John Farquhar had personally informed him that his shells were in reality collected in Durban Bay. Thus the three Durban examples from the Ponsonby collection in the British Museum, mentioned by Tomlin (1931), are possibly syntypes. Similar shells, in more or less fresh condition, are common in Durban Bay, although no living specimens have as yet come to the authors' attention.

(4) *Calliostoma bisculptum* E. A. Smith, 1906. Described from a single specimen from Durban.

(5) *Calliostoma mosselense* Tomlin, 1926. Described from Quaternary deposits on the Klein Brak River.

Sowerby (1889) did comment on the resemblance of his *Trochus fultoni* to *T. suarezensis*, but no direct comparison has hitherto been made. The inter-relationships of the other taxa were discussed by Tomlin (1931) and Barnard (1963a). The former synonymized *T. farquhari* with *T. fultoni*, but provisionally accepted *Calliostoma bisculptum* as a valid species. Barnard treated *Calliostoma bisculptum*, *Calliostoma farquhari* and *Calliostoma mosselense* all as synonyms of *Cantharidus fultoni*. However, examination of large series from various localities indicates that two morphologically distinguishable populations, isolated, as far as can be determined, both temporally and geographically, can be distinguished. These should be given subspecific rank. One population (*fultoni*) is restricted to Pleistocene deposits of the southern Cape shoreline, the other is Recent, occurring living from Natal to Tanzania and Madagascar. Specimens from the Malagasy Republic (*suaresensis*), lent to us by Dr H. Rehder, agree well in all characters (including dentition) with material from Durban and Moçambique (*farquhari* and *bisculptum*), and are clearly conspecific; *Trochus suarezensis* is thus the earliest *nomen* applicable to this taxon.

Macnae & Kalk (1969: 127) and apparently Spry (1968: 6) have utilized the name '*Calliostoma interrupta* (Wood)' for examples of *Cantharidus suarezensis*. *Cantharidus (Jujubinus) interruptus* (Wood, 1828), judging by Western Australian specimens in the N.M., is indeed superficially similar, but has a completely different colour pattern, is markedly narrower, and has more feebly pliculate interstices.

Barnard's figure (1963a: fig. 14i) of the radula of the present species is

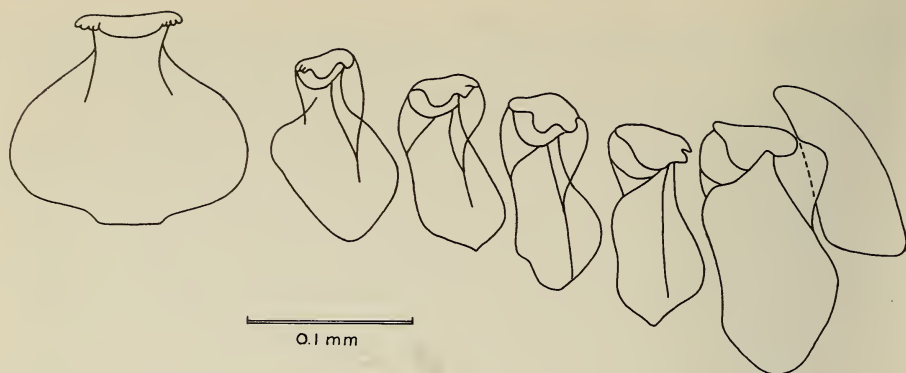


Fig. 2. Rachidian and lateral plates of *Cantharidus suarezensis suarezensis* (Fischer, 1878), with intermediate plate of preceding row drawn *in situ*.

inaccurate, and the rachidian and lateral teeth are here refigured (Fig. 2). In general the dentition closely resembles that of *C. (J.) strigosus* (Gmelin, 1791), as figured by Fischer-Piette & Gailliard (1959: 59, fig. 1). As in many trochids there is a degenerate, non-cuspidate plate between the laterals and marginals. While it seems to be conventional to follow Troschel (1879) in regarding this as an inner marginal tooth, it should be noted that this plate not infrequently bears traces of an alate side lamella, which is a characteristic of the lateral series of teeth, not the marginals. In *C. suarezensis* and others this intermediate plate seems to act as a buttress for the cutting head of the outermost lateral in the succeeding row.

We are here relegating *Jujubinus* Monterosato, 1884, to subgeneric rank under *Cantharidus* Montfort, 1810. Although maintained as a full genus by some recent authors, *Jujubinus* appears to differ only in its more angular body whorl and narrower spire angle.

Cantharidus suarezensis suarezensis (Fischer, 1878)

Fig. 3

- Trochus suarezensis* Fischer, 1878: 63; 1879: 378, pl. 115 (figs 2-2a).
Cantharidus suarezensis: Pilsbry, 1889: 130, pl. 45 (fig. 55). Dautzenberg, 1929: 332.
Calliostoma farquhari Sowerby, 1892: 43, pl. 2 (fig. 42). Syn. nov.
Calliostoma bisculptum E. A. Smith, 1906: 54, pl. 8 (fig. 4). Syn. nov.
Cantharidus fultoni (partim): Barnard, 1963a: 281, figs 14i, 19.
Calliostoma interrupta (non Wood, 1828): Spry, 1968: 6. Macnae & Kalk, 1969: 127.

Diagnosis

Distinguished by the thin, flat-topped spiral lirae, frequently arranged in pairs, particularly medially; these lirae generally number 11-16 on the penultimate whorl, more rarely as few as 6 (fide Barnard 1963a). Intervals with delicate, oblique axial plicules, which barely cross the intervening spirals.

Colour variable, often light green with articulated darker green dots on the lirae, which may, by confluence, form oblique dark green lines or flames; in others the ground colour is greenish-yellow or greenish-white with dark grey or olive-brown axial flames; these often bifurcate at the basal periphery, which may bear red marks; the intervals between the spiral lirae are characteristically orange-red, although an occasional interval may lack this colour.

Dimensions

Holotype: 18×13 mm. B/Ht 0,72.

Durban Bay: $11,9 \times 8,8$ mm; $11,0 \times 7,8$ mm; $10,9 \times 8,2$ mm. B/Ht range 0,68–1,19.

Inhaca Island: $17,8 \times 12,7$ mm; $17,6 \times 13,5$ mm; $17,3 \times 13,0$ mm. B/Ht range 0,63–1,07.

Malagasy: $11,7 \times 9,5$ mm; $11,5 \times 8,8$ mm; $11,5 \times 8,6$ mm. B/Ht range 0,74–0,81.



A



B

Fig. 3. *Cantharidus suarezensis suarezensis* (Fischer, 1878). B. Scanning electron photomicrograph showing sculpture on the base. (Inhaca Island.)

Distribution records

Natal: Durban Bay (N.M. *et auct.*). Moçambique: Inhaca Island and Delagoa Bay (N.M. and S.A.M.); Maxixe and Inhambane (S.A.M.); Bazaruto and Benguera Islands and off Inhagondo region (N.M.); Moçambique Island (Barnard and N.M.); Porto Amelia (N.M.). Tanzania: Dar-es-Salaam (N.M.). Malagasy Republic: Nossi Bé (S.A.M.); Tulear and $13^{\circ}23'S$, $48^{\circ}13'E$ (United States National Museum); numerous other localities (Dautzenberg 1929).

Barnard's (1963a) Isipingo record is doubtful as there are no suitable modern habitats nor raised beach deposits at that locality; and the specimen dredged off Cape Morgan at 47 fathoms cannot be positively identified in the South African Museum collection.

Habitat

On the sheltered mudflats on the west side of Inhaca Island and elsewhere in Moçambique *C. s. suarezensis* lives in abundance on the leaves of the marine angiosperm *Cymodocea ciliata* (Forsk.) Ehrenb. ex Aschers., which forms extensive beds along the infratidal fringe. Dautzenberg also records the species as living 'dans les Cymodocées' in the Malagasy Republic.

Cantharidus suarezensis fultoni (Sowerby, 1889)

(Revised status)

Fig. 4

Trochus (*Calliostoma*) *fultoni* Sowerby, 1889: 153; 1892: 43, pl. 2 (fig. 43).

Trochus stenomphalus Sowerby, 1889: pl. 3 (fig. 7).

Calliostoma mosselense Tomlin, 1926: 81.

Cantharidus fultoni (*partim*): Barnard, 1963a: 281.

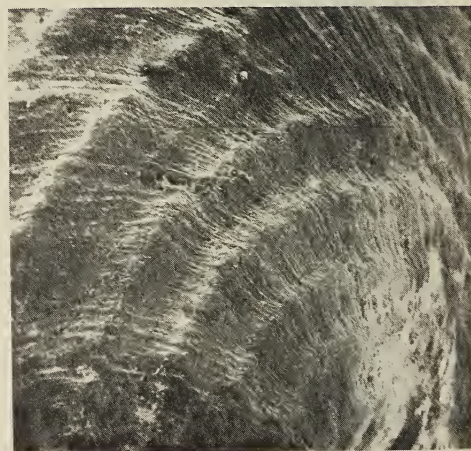
Diagnosis

Superficially smooth, but under magnification with fine declivous spiral lirae, never as strong as in the nominate subspecies, sometimes almost obsolete, although always distinct in juveniles; these lirae are also always well developed on the base. Oblique growth lines present, occasionally strong enough in places



A

5mm



B

1mm

Fig. 4. *Cantharidus suarezensis fultoni* (Sowerby, 1889). B. Scanning electron photomicrograph showing sculpture on the base. (Swartkops River mouth.)

to form fine plicules, which, however, always override the spiral sculpture, instead of forming interstitial plicules such as characterize *C. s. suarezensis*. Colour buff with oblique reddish or yellowish brown axial lines or spiral rows of dots.

Dimensions

Swartkops River: $17,0 \times 12,7$ mm; $16,9 \times 13,1$ mm; $16,7 \times 12,0$ mm.
B/Ht range 0,72–0,94.

Klein Brak River: $12,1 \times 8,9$ mm; $11,8 \times 8,3$ mm; $11,3 \times 7,8$ mm.
B/Ht range 0,65–1,00.

Sedgefield: $10,8 \times 7,5$ mm; $9,5 \times 7,3$ mm; $9,0 \times 7,6$ mm. B/Ht range 0,69–0,85.

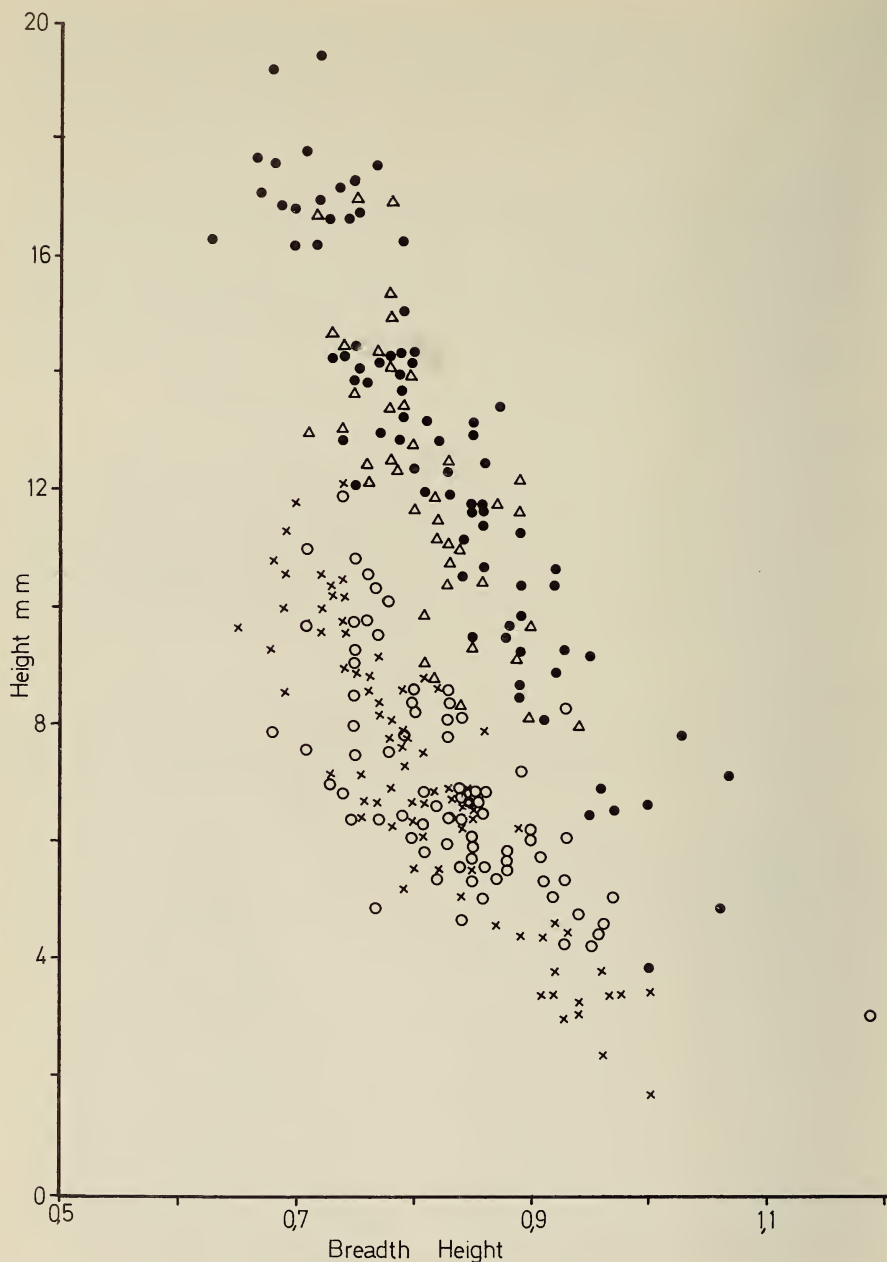
Distribution records

Type locality: Port Elizabeth, here restricted to the Swartkops River beds. The known range of the subspecies is from Algoa Bay (Coega) to the Klein Brak River, in beds of the 7 m level, and 4–5 m level. Swartkops River mouth (N.M., S.A.M.); Redhouse (N.M.); Coega River mouth (N.M., S.A.M.); Knysna 4,6 m a.s.l. (S.A.M.); Sedgefield, 5 m a.s.l. (S.A.M.); Groot Brak River (S.A.M.); Klein Brak River, 3,3 m a.s.l. (S.A.M.); Mossel Bay (N.M.).

Remarks

The diagnostic characters that serve to separate *C. s. suarezensis* and *C. s. fultoni* have already been cited. In Figures 5A and 5B height is compared with the ratio breadth/height for these two subspecies. It must be stressed, however, that sampling was non-random; specimens were selected to present an even distribution of size. As these graphs show, separation of the two subspecies on shell dimension is not possible. The marked differences even within a single subspecies may possibly be the result of habitat. For instance, as stated, the Inhaca Island sub-population of *C. s. suarezensis* lives on the broad bladed 'sea grass' *Cymodocea ciliata* (Forsk.). In Durban Bay *Cymodocea* is replaced by *Zostera*, which is the probable habitat of the local *C. s. suarezensis* population. By comparison with *Cymodocea*, *Zostera* is thin-leaved and much less robust. Arguably, *Zostera* could not support broad specimens such as live on *Cymodocea*. Figure 5 shows that the same difference in dimensions exists within *C. s. fultoni*, but unfortunately the fossil record provides no indication as to which marine angiosperms inhabited the Late Pleistocene estuaries and lagoons.

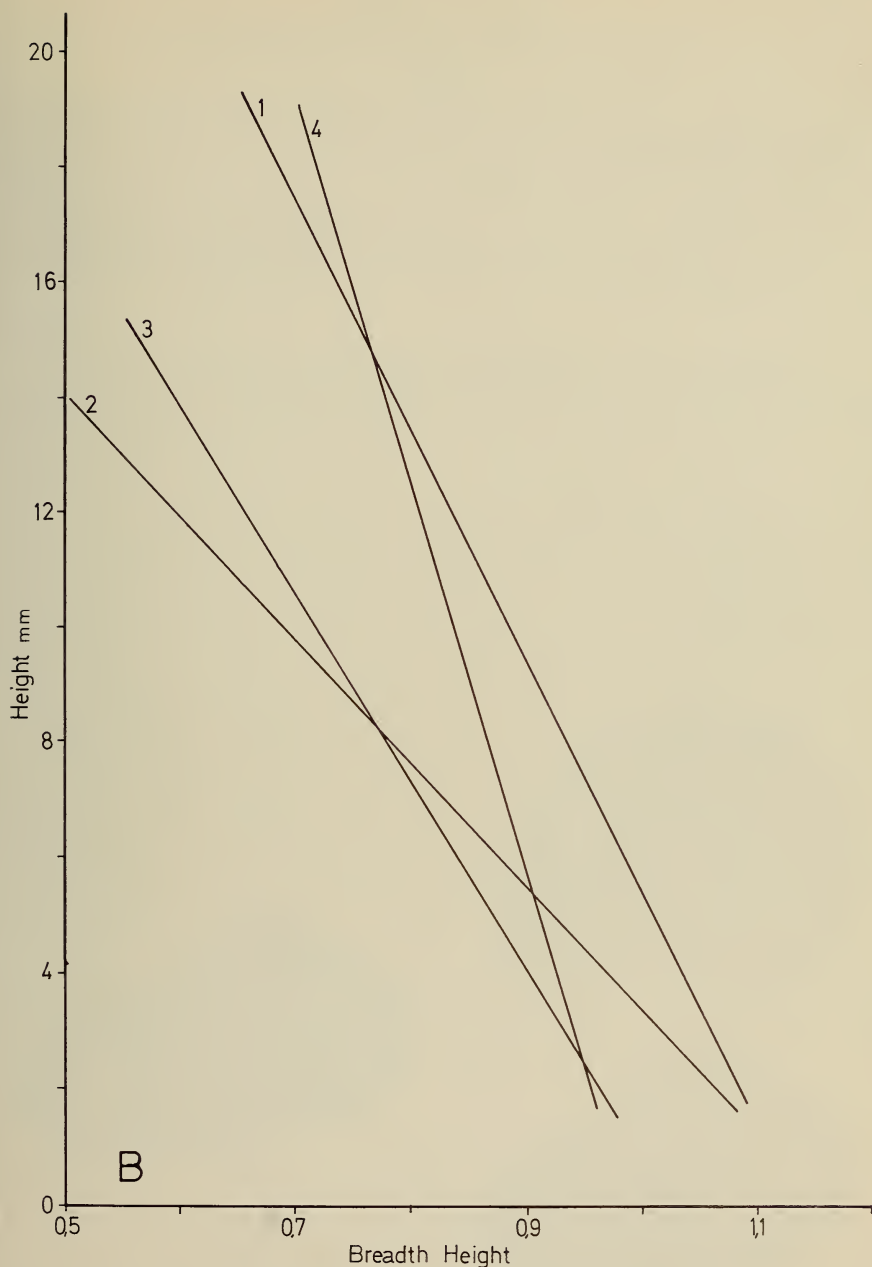
The differences in dimensions within each subspecies could equally be due to the tendency for the development of local demes. Pelagic larval stages are absent in European *Cantharidus* spp. and if this is applicable also to *C. suarezensis*, it would contribute towards the isolation of sub-populations. For example, there could be little gene exchange between the living Inhaca and Durban Bay sub-populations, and between the Late Pleistocene Swartkops River and Klein Brak River ones.



- 1. *Cantharidus suarezensis suarezensis* — Inhaca
- 2. *Cantharidus suarezensis suarezensis* — Durban Bay
- × 3. *Cantharidus suarezensis fultoni* — Klein Brak River
- △ 4. *Cantharidus suarezensis fultoni* — Swartkops

Fig. 5A

Fig. 5. Comparison of height with breadth/height for *Cantharidus suarezensis suarezensis* and *C. s. fultoni*. A. Scatter diagram. B. Calculated best-fit lines through the individual scatter diagram populations.



- 1. *Cantharidus suarezensis suarezensis* — Inhaca
- 2. *Cantharidus suarezensis suarezensis* — Durban Bay
- × 3. *Cantharidus suarezensis fultoni* — Klein Brak River
- △ 4. *Cantharidus suarezensis fultoni* — Swartkops

Fig. 5B

Family Stomatiidae

Pseudostomatella orbiculata (A. Adams, 1850)

Fig. 6

Stomatella orbiculata A. Adams, 1850: 31; 1854: 837, pl. 174 (figs 23–24). Sowerby, 1874: pl. 4 (fig. 23). Tomlin, 1923: 50.

Stomatella sp: Barnard, 1963a: 245, fig. 12a.

Distribution records

Knysna, 4,6 m a.s.l. (S.A.M.); Sedgfield, 5 m a.s.l. (S.A.M.); Klein Brak River, 3,3 m a.s.l. (S.A.M.).

Remarks

Specimens from Pleistocene raised beaches (S.A.M.) in the Mossel Bay–Algoa Bay area agree well with Recent specimens (N.M.) from Moçambique Island, Bazaruto and Santa Carolina Islands (Moçambique) and from Dar-es-Salaam. The species was recorded from Algoa Bay by Tomlin (1923), but this example was almost certainly washed out of a raised beach, as there is no other record of Recent specimens from South African waters. There are in fact numerous specimens from the Swartkops beds in the S.A.M. collection. The type locality was Moçambique and it has been recorded from as far north as Ceylon (Robertson 1969).

Barnard (1963a) described Pleistocene specimens of *P. orbiculata* in detail.

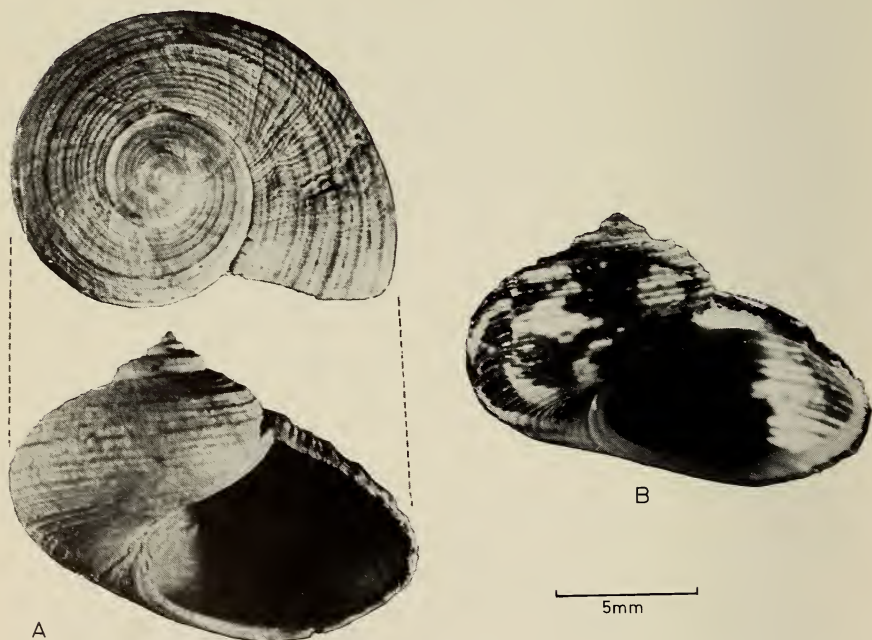


Fig. 6. *Pseudostomatella orbiculata* (A. Adams, 1850). A. Fossil (Knysna). B. Living (Dar es Salaam).

Family Potamididae

Cerithidea (Cerithidea) bifurcata sp. nov.

Fig. 7

?Cerithium cf. guinaicum (non Philippi): Haughton, 1932: 45.*Type material*

Holotype: SAM-K4496.

Paratypes 1 and 2: NM-A 80/T 1821.

Paratype 3: SAM-K4563.

Diagnosis

Apex decollate, later part of spire cyrtconic, sutures narrowly canaliculate; sculpture of fine axial riblets and well-developed subsutural crenules, crossed by fine spiral lirae.

Description

Adult acuminate pupoid, with flaring aperture and decollate apex; whorls gently convex, periphery situated at base of each whorl; sutures very narrow but canaliculate. Aperture rounded quadrate, angular posteriorly, with a small parietal denticle in the angle, labium evenly curved, margin of columella callus free, but not erect; labrum evenly rounded, gently opisthocline; siphonal canal short, very oblique, truncate, and deeply channelled. Axial sculpture consists of fine, close, opisthocyrt riblets, about 35–41 in number on penultimate whorl, rather weak towards back of lip, developing below the suture into strong crenule-like nodules, 17–20 on the penultimate whorl. Spiral sculpture is present anterior to these nodules, consisting of three narrow and sometimes very shallow grooves on the penultimate whorl; their intervals are flattened, rarely forming nodules at the intersections with axial ribs; spiral grooves are more closely spaced on base of body whorl. One specimen retains traces of brown coloration in the spiral grooves.

Adults (two 'complete' examples available) retain $5\frac{1}{2}$ whorls; no perfect juveniles have been seen, but the only two immature specimens examined show 7 and $8\frac{1}{2}$ whorls respectively (their apices seem to be broken, however). The exact stage at which decollation occurs cannot at present be estimated.

*Dimensions*Holotype: adult, $20,6 \times 10,1$ mm.Paratype 1: adult, $21,6 \times 10,7$ mm.Paratype 2: juvenile, $25,8 \times 10,8$ mm (labrum broken).Paratype 3: juvenile, $19,9 \times 7,7$ mm.*Distribution records*

Early Pleistocene beach deposits at 9,5 m a.s.l., 1,5 km north-east of Langebaan in quarry (type locality).

Remarks

The naturally decollate apex distinguishes *C. bifurcata* from most members of the genus *Cerithidea* Swainson, 1840, certainly from all Recent Atlantic species. The closest ally to *C. bifurcata* appears to be *C. decollata* (Linnaeus, 1758), a Recent Indo-Pacific species common in mangrove swamps in Natal, but living among salt marsh vegetation in estuaries as far west as the Gamtoos River (approx. 25°05'E). *C. decollata* differs in possessing regular suture-to-suture axial ribs, a shallower siphonal canal, a definite posterior apertural angle, and non-channelled sutures.

The pupoid shape and subsutural crenules of *Cerithidea bifurcata* may have led to Tomlin (in Haughton 1932) misidentifying it as the Recent tropical Atlantic *Cerithium guinaicum* Philippi, 1849; in complete specimens shape and sculptural details are very dissimilar.



Fig. 7. *Cerithidea (Cerithidea) bifurcata* sp. nov. Holotype. (Quarry 1,5 km north of Langebaan.)

Family **Cerithiidae***Cerithium scabridum rufonodulosum* E. A. Smith, 1901
(Revised status)

Fig. 8

Cerithium mediterraneum (non Deshayes): Sowerby, 1892: 35. Turton, 1932: 125.*Cerithium rufonodulosum* E. A. Smith, 1901: 108, pl. 1 (fig. 8). Barnard, 1963: 131.*Cerithium vulgatum* (non Bruguière): Bartsch, 1915: 116. Turton, 1932: 125.*Distribution records*

4–5 m and 7 m levels: Coega River mouth (S.A.M.); Redhouse (S.A.M.); Knysna, 4,6 m a.s.l. (S.A.M.); Sedgfield, 5 m a.s.l. (S.A.M.); Groot Brak River (S.A.M.); Klein Brak River, 3,3 m a.s.l. (S.A.M.); Arniston (S.A.M.).

Remarks

As in the case of several other Cape Pleistocene molluscs, *C. rufonodulosum* from Port Elizabeth was described as a Recent species. These specimens were no doubt washed out of raised beaches along the banks of the Swartkops River. The Port Alfred specimens recorded as *C. vulgatum* and *C. mediterraneum* were also presumably derived from local deposits. *Cerithium rufonodulosum* closely resembles Sowerby's figure of his *C. nigropunctatum* (1855: 860, pl. 180, fig. 97) from an unknown habitat, as was indicated by Smith. Unfortunately the original description of *C. nigropunctatum* contains insufficient detail, and from Smith's phraseology it would appear that the types are lost. Reeve (1865*a*) omitted the

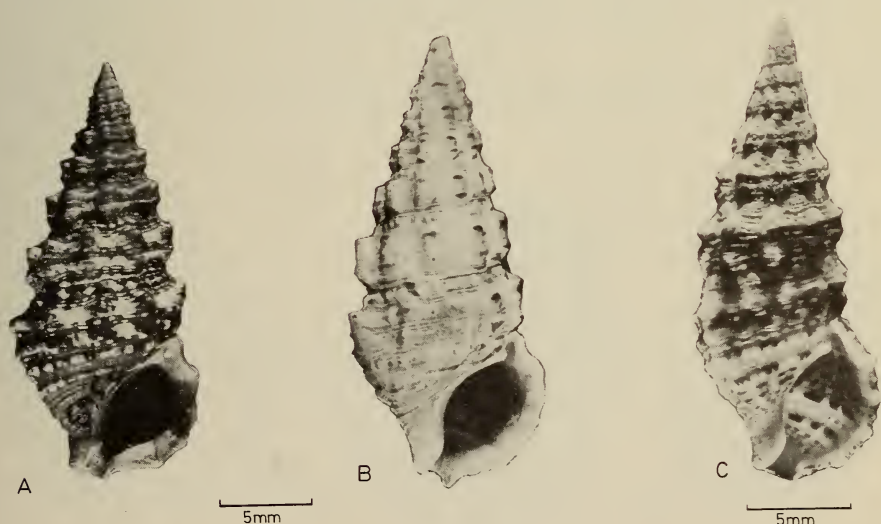


Fig. 8. A. *Cerithium scabridum rufonodulosum* E. A. Smith, 1901 (Algoa Bay). B. *C. s. rufonodulosum* E. A. Smith, 1901 (Sedgfield). C. *C. s. scabridum* Philippi, 1848 (Muscat, Gulf of Oman).

species, and Kobelt (1898: 242, pl. 42, fig. 10) merely copied Sowerby's description and figure. *C. nigropunctatum* must therefore be rejected as a *nomen dubium*, at least until the type (if extant) is located. The possibility does exist, nevertheless, that it may indeed be based on a discoloured specimen of the present species.

Of Recent species *C. rufonodulosum* appears to be allied only to *Cerithium scabridum* Philippi, 1848. This species is recorded from the Red Sea, Persian Gulf and India, south to the Mascarene Islands and Quirimba Island (12,4°S, 40,7°E), but has not yet been reported from farther south. The morphological differences between *C. scabridum* and *C. rufonodulosum* are very small and we believe that the relationship should be regarded as a subspecific one. Comparison with specimens of *C. s. scabridum* from the Gulf of Oman (N.M.: F. Luther) shows it to differ from *C. s. rufonodulosum* only in having less prominent tubercles. While fresh examples of *C. s. scabridum* are pale greyish, sometimes zoned with orange-brown, and with rows of articulated black and white marks crossing the rows of tubercles, an old, dead specimen is light brownish-buff with dark brownish-orange tubercles, exactly as in most South African *C. s. rufonodulosum* (some examples are tinged violet), suggesting that the coloration to be seen in specimens of the latter is secondary.

A syntype of *C. s. rufonodulosum* (NM-1041/T512) measures 22,5 × 8,7 mm. It is here designated as lectotype; although the labrum is broken it is otherwise in good condition.

Family Calyptraeidae

Crepidula capensis praerugulosa subsp. nov.

Fig. 9

Crepidula rugulosa Dunker, 1846 (*partim*). Barnard, 1963: 72, fig. 9f.

Type material

Holotype: SAM-K4564.

Paratypes 1-8: NM-9229/1825.

Paratypes 9-11: SAM-K4580.

Diagnosis

A Pleistocene chronosubspecies of *Crepidula capensis* Quoy & Gaimard, 1835, differing in its marginal apex and larger size, and in the absence of rugose sculpture.

Description

Outline curved-pyriform, breadth variable, apex spirally coiled, situated on postero-lateral margin, protoconch frequently retained in moderately large specimens; outer surface with regular, well-marked growth lines. Septum as in *Crepidula capensis*, i.e. margin sigmoid, shallowly concave on right, with a prominent lobe to the left of the midline, and a deep, narrow sinus on the left side.

Dimensions

Holotype: 27,1 × 21,7 mm.

Paratypes: 27,7 × 18,2 mm;

35,6 × 31,0 mm.

Distribution records

Late Pleistocene: found extensively in exposures of 7 m beach adjacent to present open coast between Elands Bay and Saldanha Bay; Kruispad, 4,6 m a.s.l. (S.A.M.); Velddrif West, 4-7 m a.s.l. (S.A.M.) (type locality); Milnerton lagoon (S.A.M.).

Remarks

Although many species of *Crepidula* are notoriously variable in shell shape, the numerous specimens of *C. c. praerugulosa* show its characters to be relatively constant, save for some variation in proportions as discussed below. While it is always distinguishable from *C. capensis* Quoy & Gaimard, 1835 (syn. *C. rugulosa* Dunker, 1846, cf. Kilburn, 1974), the form of the septum and general shape of *C. c. praerugulosa* agree very closely with that species. *C. capensis* does not occur in the same deposits, and it seems advisable to rank *C. c. praerugulosa* as a chronosubspecies rather than as a full species.

The regularly curved ventral margin of *C. c. praerugulosa* suggests that it lived attached to mussel shells, a common habitat of *Crepidula porcellana* Lamarck, 1801. *C. c. capensis* appears to live entirely on the undersides of rocks. Indeed the wide range of proportions found in *C. c. praerugulosa* (breadth ranging between 0,66 and 0,87 of length) somewhat parallels that of *C. porcellana*. In the latter species the broader form generally occurs in individuals attached to the wider, flatter, posterior part of the bivalve surface, while the narrower form generally lives on the strongly curved anterior or umbonal part. Possibly the same may have applied to *C. c. praerugulosa*. One paratype even shows a series



Fig. 9. *Crepidula capensis praerugulosa* subsp. nov. Holotype. (Velddrif West.)

of xenomorphic ridges, strongly suggesting attachment to the ribbed mussel *Aulacomya ater* (Molina, 1782).

In addition to the type series of *C. c. prae rugulosa*, a set of eight specimens from an older deposit 1,5 km north of Langebaan (9,5 m a.s.l.) has been examined. These are in a very poor state of preservation, but are morphologically most interesting. Not only is the apex in these specimens more terminal than in typical *C. c. prae rugulosa*, and the shells on the average more compressed, but the left side of the septum appears to be less lobate. This might be construed as indicating an origin from a *porcellana*-type ancestor. Much more and better material is needed, however.

Family **Buccinidae**

***Triumphis dilemma* sp. nov.**

Fig. 10

Type material

Holotype: SAM-K4565.

Paratype 1: NM-A1217/T1827.

Diagnosis

Anal canal well developed; shell covered by thin spiral lirae with feeble axial folds on the spire.

Description

Ovate-fusiform, aperture nearly twice length of spire, whorls moderately convex, aperture constricted, labrum thickened, expanded, anal canal trough-like, rendering the lip shouldered; labrum with ten internal ridges, terminating in denticles of which the anterior two are partially fused; labium with a

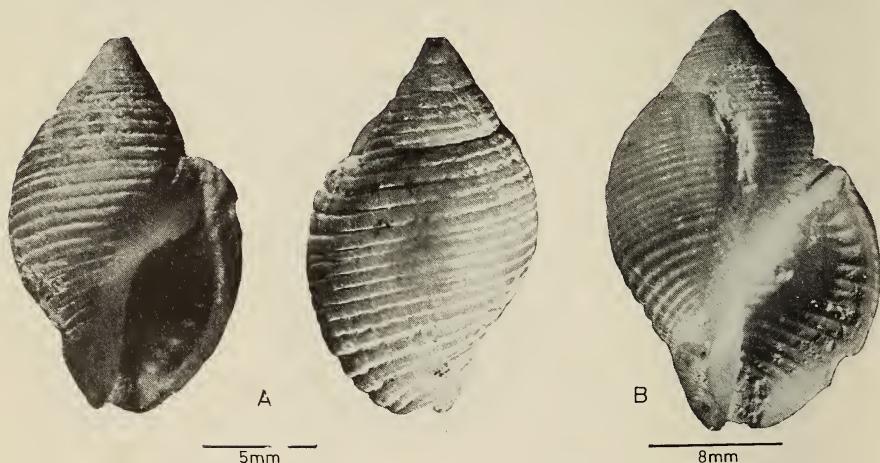


Fig. 10. *Triumphis dilemma* sp. nov. A. Holotype. B. Paratype 2. (Quarry 1,5 km north of Langebaan.)

moderately wide, flattened callus, which is continuous with that of the labrum; paries with one or two denticles, columella with three basally; fasciole weak. Sculptured by tabulate spiral cords, with sharply incised intervals; cords 5–6 in number on penultimate whorl, 17–18 on body whorl, median ones on last whorl mostly shallowly bisected; intervals between cords with fine axial plicules; spire with obscure traces of axial folding. Apex worn, four teleoconch whorls remaining.

Dimensions

Holotype: $16,3 \times 10,4$ mm.

Paratype 1: $14,8 \times 9,3$ mm.

Paratype 2: $24,9 \times 16,0$ mm.

Distribution records

Early Pleistocene at Langebaan, 9,5 m beach (type locality).

Remarks

Although the thickened labrum and fully-developed apertural characters suggest that the type specimens are adult, two larger specimens from the same deposit are probably conspecific. The latter are, however, in poor condition (one being fragmentary), and there are no intermediate specimens to connect the two extremes. They are therefore excluded from the type material. Although similar in general shape, proportions and sculpture, these larger individuals show reduced development of the anal canal, less constricted apertures and reduced lip denticles. Thus the labrum is lirate internally, without denticles, the columella pustules are weak, and the paries bears only one low tubercle. On the body whorls of these two specimens there are 25–34 spiral ridges. The more complete specimen (four teleoconch whorls remaining, apex worn) measures $25 \times 16,3$ mm.

The affinities of *Triumphis dilemma* are not clear. In some respects it resembles species of the genus *Cantharus* Röding, 1798, but in apertural characters is closer to *Triumphis* Gray, 1857. It differs from the Recent Panamic *T. distorta* (Wood, 1838) in shape, in the presence of sculpture over the whole surface, and in the less developed anal canal.

Family Terebridae

Duplicaria otiosa sp. nov.

Fig. 11

Type material

Holotype: NM-8185/T1832.

Paratype: SAM-K4567.

Diagnosis

Small (15,0 mm), with 11 strong, rounded axial ribs with sloping sides, shallowly cut by a subsutural groove, demarcating a series of oblong subsutural nodules; no other spiral sculpture.

Description

Acuminate, 7 teleoconch whorls; whorls strongly convex; spire about twice length of aperture; siphonal fasciole strongly twisted and carinate, columella thinly calloused, aperture elongately ovate-rhombic. Subsutural groove situated one-third of whorl length from upper suture, shallow, incising axial ribs, but barely cutting interstices; only visible from the 4th whorl onwards. Axial ribs extending from suture to suture, feebly opisthocyrt, rounded with gently sloping sides, narrower than intervals, strongly developed throughout, 11–12 in number on first teleoconch whorl, 11 on penultimate whorl; posterior part of each rib (cingulum), where cut off by the sulcus, is axially oblong, not noduliform. No sign of spiral striae, but growth lines conspicuous. Protoconch worn, bluntly conical, of about $2\frac{1}{4}$ whorls.

Dimensions

Holotype: $14,5 \times 4,5$ mm.

Paratype: $16,4 \times 4,6$ mm, labrum broken.



Fig. 11. *Duplicaria otiosa* sp. nov. Holotype. (Coega salt works.)

Distribution records

Pit at Coega salt works, 4,5 m a.s.l. (type locality).

Remarks

Closely allied to *Strioterebrum (Partecosta) wilkinsi* Dance & Eames, 1966, from the Recent Hammar Formation of Iraq. *Duplicaria wilkinsi* differs in its more nodular subsutural band, in the development of the subsutural groove on the early whorls and in its convex whorl profile. Cernohorsky (1969: 221) lists *D. wilkinsi* as a synonym of the unfigured *Terebra fuscobasis* E. A. Smith, 1877. However, Melvill & Standen (1917: 208) noted the presence of spiral microstriae in the latter, these being apparently absent in both *Duplicaria wilkinsi* and *D. otiosa*.

Of species recorded from South Africa *D. otiosa* resembles only *D. evoluta* (Deshayes, 1859) from Natal and the Indo-Pacific; this is a much larger species (30–40 mm), with a bigger protoconch and a finely punctate subsutural groove, with the axial ribs shouldered where they border the latter.

The radula of *D. otiosa* will never be known, and we are referring it to the genus *Duplicaria* Dall, 1908, on account of its general resemblance to Recent species such as *D. evoluta* and *D. fictilis* (Hinds, 1845).

Family Actaeonidae

Pupa (Strigopupa) daviesi sp. nov.

Fig. 12

Actaeon (Solidula) suturalis (non A. Adams): Sowerby, 1892: 52.

?*Actaeon pudica* (non A. Adams): Turton, 1932: 2.

Solidula sulcata (non Gmelin, 1791): Barnard, 1962: 192 (*partim*); 1963a: 316.

?*Solidula suturalis*: Barnard, 1963a: 316.

Type material

Holotype: SAM-K4568.

Paratypes: NM-A1218/T1828;

NM-A1219/T1827;

NM-8186/T1824.

Diagnosis

Narrowly pupoid, lip flattened, left side of base obliquely truncate, columella with a single bifid fold, no parietal tubercle, sculpture of low, tabulate spiral ridges; axial colour lines visible under ultraviolet light.

Description

Narrowly pupiform, with acute, cyrtconical spire, sutures moderately deep but not channelled, whorls gently convex; profile of labrum somewhat flattened in middle, basally initially sharply rounded, becoming obliquely truncate on left

side, which lies in plane of curvature of left side of body whorl profile. Columella with a single strong fold, shallowly bisected by a groove, paries fairly straight above, strongly curved below, basal parietal tubercle absent. Surface sculptured by low, flat-topped spiral ridges separated by narrow grooves; first teleoconch whorl with three spiral cords, increasing to 7–11 on the fourth whorl; in the middle of the body whorl these ridges tend to be bisected by median grooves, and on the base split into thinner and more widely spaced lirae. Growth lines regular and rather coarse, crossing spiral cords and forming fine plicules in the intervals, rendering these superficially foveolate.

Shell always bleached, but under U.V. illumination pigments fluoresce to produce a negative pattern of numerous thin, wavy axial lines, the posterior ends of which tend to fuse below the suture.

Dimensions

Holotype: 14,6 × 6,8 mm.

Paratypes: 21,6 × 10,0 mm;

20,8 × 9,4 mm;

20,8 × 9,3 mm.

Distribution records

Coega salt works, 4–7 m a.s.l. (N.M.); Redhouse, 7 m a.s.l.; The Creek, 5,7 m a.s.l.; Knysna, 4,6 m a.s.l. (S.A.M.) (type locality); Sedgefield, 5 m a.s.l. (S.A.M.); Klein Brak River, 3,3 m a.s.l. (N.M., S.A.M.). See Davies (1972) for site information.

Remarks

Pupa daviesi was initially reported from South Africa as the Philippine *Pupa suturalis* (A. Adams, 1855), as indicated by N.M. material originally from the Crawford collection, on specimens from which Sowerby based his 1892 record. Some of these were subsequently sent by Henry Burnup to E. A. Smith as *P. 'suturalis'*, and were returned as *P. 'solidula' var.* J. R. le B. Tomlin, who saw the same material, disagreed with both identifications, but did not suggest an alternative. We agree that neither *P. suturalis* nor *P. solidula* is at all similar to the present species. Adams (1855: 61) in his original description of *P. suturalis* stressed the conspicuously channelled suture, this being shallow in *P. daviesi*. *P. solidula* (Linnaeus, 1758) is a large (20–30 mm), globose species with very different columella folds and a rounded base. *P. daviesi* was probably the species that was recorded from Port Alfred beach drift as *Acteon pudica* (A. Adams, 1855) by W. H. Turton. Judging by Reeve's figure (1865a: pl. 3 fig 13) this is a true *Acteon* (with simple columella pleat); otherwise it does resemble *Pupa daviesi* in form and sculpture, but has a wider aperture and a rounded base.

P. daviesi is referable to the subgenus *Strigopupa* Habe, 1958, which includes only a few species, all characterized by their obliquely truncate base and

strigate colour pattern. Other species referable here are *P. strigosus* (Gould, 1859), *P. affinis* (A. Adams, 1855) and *P. fumata* (Reeve, 1865). *P. strigosus* from Japan appears to have a far more prominent double columella fold than any of the others; it shows a well-developed parietal denticle, and has the groove separating this from the columella fold markedly reduced; spiral sulci are fewer than in *P. daviesi*. *P. affinis* (of which *P. fumata* should be regarded as a synonym) is even closer to *P. daviesi*, differing only in possessing a parietal tubercle and a more strongly bisected columella fold; although generally slightly narrower than *P. daviesi*, there is some overlap in this respect. *P. affinis* at the present day lives as far south as Durban Bay (it is the species misidentified by Barnard (1963a: 316) as *Solidula sulcata* (Gmelin, 1791)). In all probability *Pupa daviesi* originated as an isolated deme of the *P. affinis* population, but in view of the structural differences we believe that it should be given full species status. This species has been named in honour of Professor O. Davies, collector of much of the Natal Museum Pleistocene material used in this study.

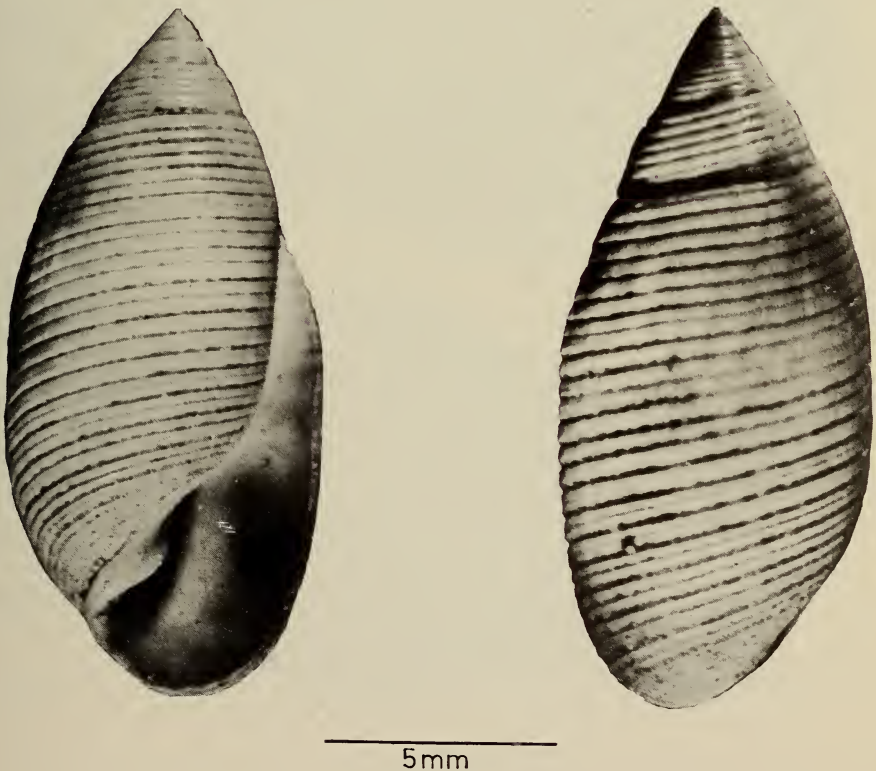


Fig. 12. *Pupa (Strigopupa) daviesi* sp. nov. Holotype. (Knysna.)

Class BIVALVIA

Family Nuculanidae

Nuculana (Lembulus) bicuspidata (Gould, 1845)

Fig. 13

Nucula (Leda) bicuspidata Gould, 1845: 37.

Nucula largillierti Philippi, 1851: 87.

Leda plicifera A. Adams, 1856: 50.

Laeda bicuspidata Hanley, 1859: 118, pl. 228 (fig. 73). Sowerby, 1871: pl. 2 (figs 8a-b).

Leda bicuspidata: Nicklès, 1950: 163, fig. 301; 1955: 110 (further references).

Description

Cape Pleistocene material: nuculaniform, rostrum conspicuous but short, very truncate; shell thin; umbo anterior to midline, antero-dorsal and anterior margins well rounded, ventral margin gently convex, postero-dorsal margin long

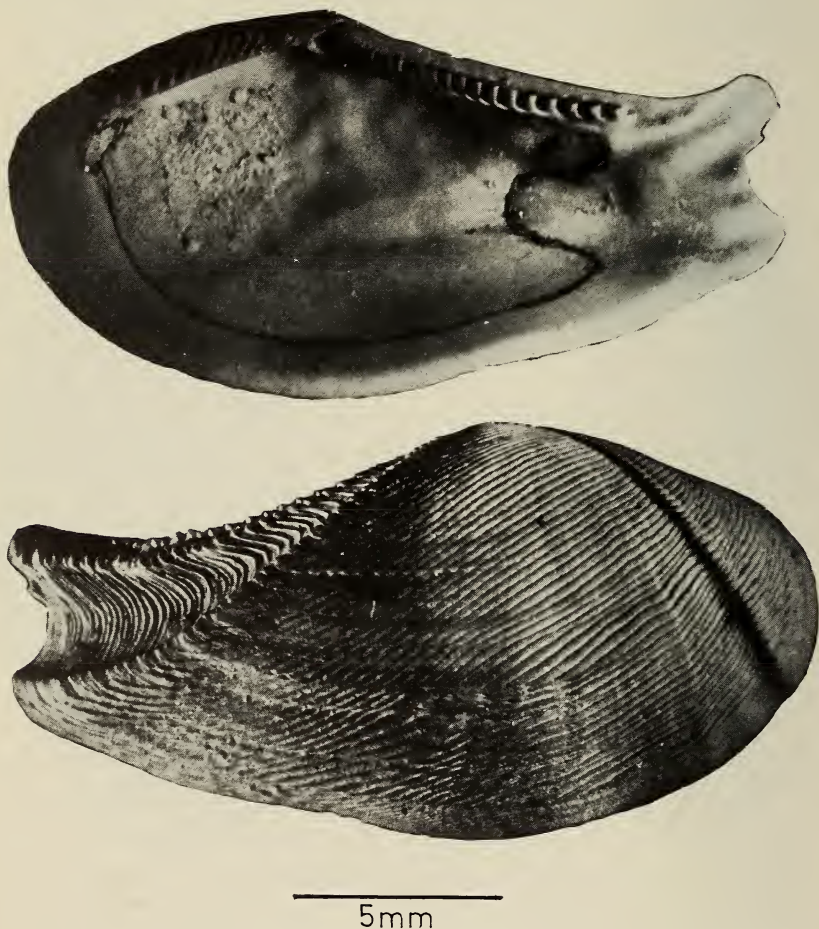


Fig. 13. *Nuculana (Lembulus) bicuspidata* (Gould, 1845). (Kruispad, Velddrif.)

and slightly concave. Surface sculpture of regular, oblique, sharply incised ribs, becoming concentric anteriorly, growth lines faint. Posterior end with a prominent broad sulcus, bordered in front by a sharp umbonal ridge, and behind by a broader dorsal ridge, rendering posterior margin bicuspidate; this sulcus is crossed by lunulate, comarginal ridges, which form small squamose denticles along the crest of the umbonal ridge, and two similar rows on the dorsal ridge, separated by a shallow furrow. Anterior end bearing a low, narrow umbonal ridge, bordered behind by a shallow concavity, rendering the margin sinuous at this point; surface anterior to the ridge sometimes with 1 or 2 feeble radial lirae. Resilifer small, triangular; hinge teeth chevron shaped, at shell length of 18 mm with 25 teeth posteriorly, 21 anteriorly. Lunule concave, lanceolate, extending to posterior end, bearing growth lines only. Muscle scars and pallial line very weakly impressed, pallial sinus short, ascending, not confluent with pallial line.

Dimensions

17,1 × 9,5 mm, 17,1 × 9,4 mm, 16,6 × 9,3 mm.

Distribution records

Redhouse (S.A.M.); Kruispad, 5,1 m a.s.l. (S.A.M.); Milnerton (S.A.M.).

Remarks

Pleistocene material agrees well with published figures and with a Recent N.M. specimen from Senegal. The species at the present day ranges from Mauritania to Angola (Nicklès 1950). A closely allied species, *N. gruveli* Nicklès, 1952, from the Quaternary of Gabon, differs in having a weaker posterior sulcus, a more central umbo, and in being less truncate posteriorly.

The only two comparable species known from South Africa are *N. lamellata* Sowerby, 1904, and *N. gemmulata* Sowerby, 1904, both Recent species from moderately deep water off Natal/Zululand. In these two the posterior sulcus is traversed by a median ridge or ridges, and there is no anterior umbonal ridge.

Family Ungulinidae

Felania diaphana (Gmelin, 1791)

Fig. 14

Venus diaphana Gmelin, 1791: 3292.

Lucina adansonii Reeve, 1850 (*non* Orbigny): pl. 9 (fig. 51).

Lucina senegalensis Reeve, 1850: appendix.

Felania diaphana: Recluz, 1851: 71. Chavan, 1962: 5.

Felania rosea Recluz, 1851: 72, pl. 2 (figs 10–12).

Diplodonta [*sic*] cf. *senegalensis*: Smith in Rogers, 1906: 294.

Diplodonta (*Felania*) *diaphana*: Lamy, 1920: 371 (references). Fischer-Piette, 1942: 317, pl. 14 (fig. 7) (holotype). Nicklès, 1950: 188, fig. 351.

?*Diplodonta* (*Felania*) *agulhasensis* Thiele & Jaekel, 1931 (*partim*): 219. Barnard, 1964: 468.

Diplodonta cf. *senegalensis*: Van Hoepen, 1940: 191. Barnard, 1962: 185; 1964: 463.

Ungulina alba (*non* Rang): Fischer-Piette in Davies, 1972: 254.

Distribution records

Cenozoic: Swartkops River (S.A.M.); Coega salt works, 7,1 m a.s.l.; Redhouse, 7,2 m a.s.l.; Cradock, 13,5 m a.s.l.; Deal Party, 5,1 m a.s.l.; Knysna,

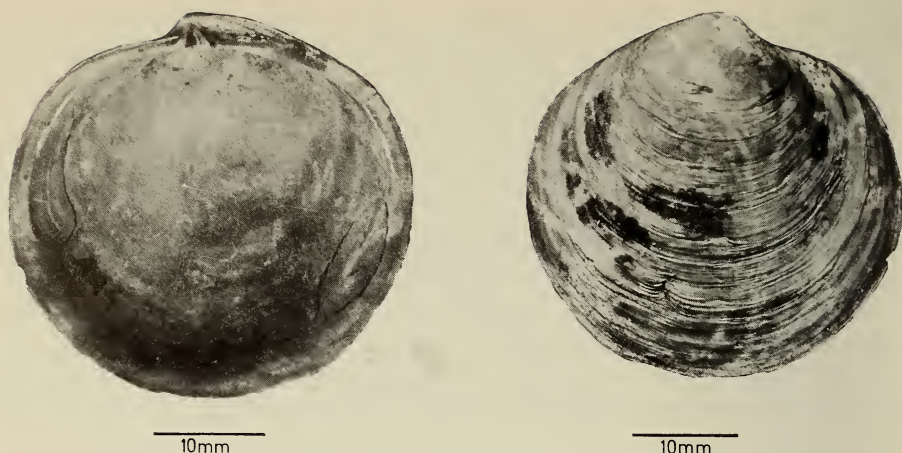


Fig. 14. *Felania diaphana* (Gmelin, 1791). (Mossel Bay.)

4,6 m a.s.l. (S.A.M.); Sedgfield, 5 m a.s.l. (S.A.M.); Klein Brak River, 3,3 m a.s.l. (S.A.M.); Mossel Bay (N.M.); Cape Cross Bay, S.W.A. (N.M.). See Davies (1972) for site descriptions.

Remarks

This Recent West African species is fairly common in raised Pleistocene beaches along the south Cape coast. Such specimens agree closely with figures of *Felania diaphana*, and with valves from the Cuanza River mouth, 75 km south of Luanda, Angola (N.M.: B. R. Stuckenberg). A rather fresh right valve from Cape Cross Bay, South West Africa (N.M.: O. Davies) may indicate the Recent occurrence of the species within South African limits. However, Thiele & Jaeckel's record (1931: 219) of the species (as *Diplodonta (Felania) rosea*) from deep water on the Agulhas Bank requires confirmation. The species at present is known to range from Mauritania to Angola (Nicklès 1950).

Family Lucinidae

Loripes (Microloripes) liratula (Sowerby, 1889)

Fig. 15

Lucina (Divaricella) liratula Sowerby, 1889: 155, pl. 3 (fig. 5); 1892: 61, pl. 2 (fig. 63).

Lucina liratula: Haughton, 1932: 35.

Lucina contempta (non Cossman): Turton, 1932: 235, pl. 62 (fig. 1641).

Divaricella liratula: Barnard, 1964: 479.

Description

Subcircular, moderately compressed; sculptured by growth lines and fine acentric lirae, which are rather irregular, but tend to be somewhat oblique across the middle, distinctly undulating at each end. Lunule small, ovate,

concave, wider in right valve than left. Resilifer deep, internal, oblique. Hinge plate narrow; right valve with a strong, elevated anterior lateral tooth, a ridge-like posterior lateral, partly overlying distal end of resilifer, and a single oblique cardinal; left valve with anterior and posterior ridge-like laterals and a cuneiform anterior cardinal with a low posterior cardinal ridge adjacent to it. Anterior adductor scar flexuous. Internal margin crenulate.

Dimensions

17 × 17 mm, 16,2 × 16,5 mm, 15,2 × 15,4 mm.

Distribution records

Swartkops River (S.A.M.); Cradock, 13,5 m a.s.l.; Coega salt works, 7,1 m a.s.l. (S.A.M.); Knysna, 4,6 m a.s.l. (S.A.M.); Sedgfield, 5 m a.s.l. (S.A.M., N.M.); Groot Brak River (S.A.M.); Klein Brak River, 3,3 m a.s.l. (S.A.M.); Verlorevlei, 4 m a.s.l. (S.A.M.); Kruispad, 5,1 m a.s.l. (S.A.M.); Bloemendal (S.A.M.); Geelbek, 4,5 m a.s.l. (S.A.M.); Churchhaven, 1,5 m and 4,3 m a.s.l. (S.A.M.).

Remarks

The present species was described as a *Divaricella*, but its oblique internal ligament shows it to be a *Loripes*. We follow Chavan (1937) in treating *Microloripes* as a subgenus of *Loripes*, in preference to his 1969 system under which it is transferred to the genus *Parvilucina*. In *Parvilucina* the ligament is sunken, but not internal, and lies parallel to the dorsal margin.

Descriptions and figures strongly suggest that *Loripes liratulula* is a synonym of the Recent West African *Loripes* (*Microloripes*) *contrarius* (Dunker, 1846). However, as no comparative material is available, we are forced to retain Sowerby's name *pro tem*. Although described and recorded as a Recent species, *L. liratulula* appears to be extinct in South Africa, beach specimens being derived from Pleistocene deposits.

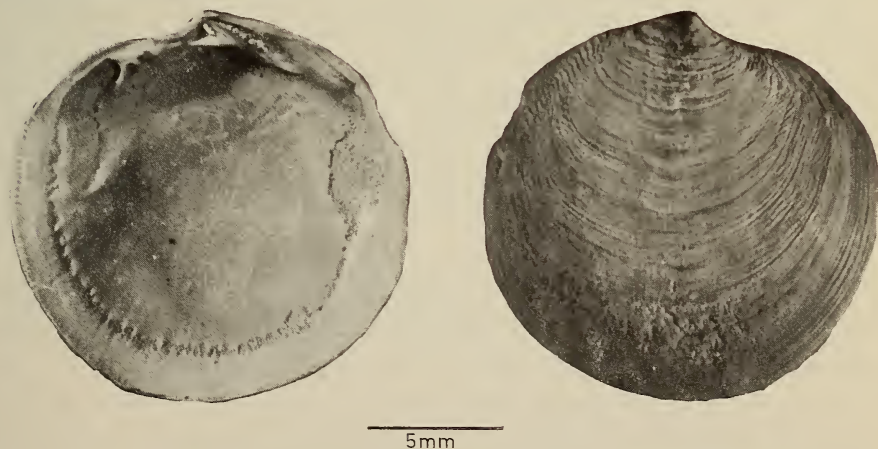


Fig. 15. *Loripes* (*Microloripes*) *liratulula* (Sowerby, 1889). (Kruispad, Velddrif.)

Family Veneridae

Pitar (Lamelliconcha) madecassina (Fischer-Piette & Delmas, 1967)

Cytherea manillae (non Sowerby, 1851): Sowerby, 1897: 24.

Pitaria manillae Barnard, 1964: 503. Boshoff, 1965: 164, pl. 10 (fig. 2).

Dosinia (Sinodia) madecassina Fischer-Piette & Delmas, 1967: 12, pl. 3 (figs 17-19).

Pitar (Lamelliconcha) madecassina: Fischer-Piette, 1968: 789, pl. 1 (figs 3-4).

Distribution records

Cenozoic: Cradock, at head of Papkuils estuary, 15,2 m a.s.l. (N.M.).

Remarks

Fischer-Piette (1968) compared *Pitar madecassina* with *P. manillae*, and recorded the former from various localities in Moçambique and Natal. He did not, however, suggest that this was the species that had previously been reported from South Africa as *P. manillae*. *P. madecassina* ranges from the type locality, Madagascar, south to Pondoland (Mzamba, N.M.; Port St Johns, S.A.M.). Although articulated specimens are rarely washed up on the shore, the species lives in abundance at depths of 12-50 fathoms off Natal.

Barnard (1962: 185; 1964: 503) erred in regarding '*Chamelea*' *schwarzi* Newton, 1913 (syn. '*C.*' *rogersi* Newton, 1913, first reviser Barnard, 1962) as being based on worn *P. madecassina*. This late Cenozoic species differs conspicuously from *P. madecassina* in its compressed valves, oblong-ovate shape, moderately curved umbo and weak umbonal ridge; also the anterior and median cardinals of the left valve only intersect at the very dorsal margin. *P. madecassina* is tumid, ovate-trigonal, posteriorly subrostrate with a strong umbonal ridge, umbo strongly prosogyrate, left anterior and median cardinals intersecting some distance below the dorsal margin. '*Chamelea*' *krigei* Newton, 1913, is even more different in form and dentition.

Venerupis dura (Gmelin, 1791)

Fig. 16

Venus dura Gmelin, 1791: 3292.

Tapes dura var. *simili* [sic] (? non *similis* Deshayes, 1853): Schwartz, 1910: 116.

Venerupis (Polittapes) dura: Nicklès, 1950: 203, fig. 387.

Macrocallista lilacina (non Lamarck, 1818): Barnard, 1964: 505.

Venerupis dura: Fischer-Piette & Métivier, 1971: 11 (references and synonymy).

Venerupis rufiscensis Fischer-Piette & Métivier, 1971: 13, pl. 3 (figs 2-7). Syn. nov.

Distribution records

Cenozoic: Redhouse (S.A.M.); Knysna, 4,6 m a.s.l. (S.A.M.); Geelbek (S.A.M.); Kruispad, 5,1 m a.s.l. (S.A.M.); Verlorevlei, 4 m a.s.l. (S.A.M.).

Remarks

Venerupis dura is a West African species, living as far south as Luanda (Angola), but also abounding in Late Pleistocene sediments of the south-western and southern Cape. This extinct deme differs morphologically from the Recent



Fig. 16. *Venerupis dura* (Gmelin, 1791). (Kruispad, Velddrif.)

form in its weak to almost obsolete concentric sculpture; while in most specimens shallowly incised concentric grooves are present, in some examples coarse growth lines are the only external surface feature. In addition the pallial sinus is usually somewhat narrower and sharper than in Recent Angolan *V. dura*. Mr C. P. Nuttall, who kindly examined specimens from Verlorevlei, has suggested (*in litt.* 26 August 1971) that these may be comparable with '*Callistotapes vetulus* (Basterot) var. *plioglabroides* Sacco from the Pliocene (Astian) of Piedmont', Italy.

The S.A.M. specimens recorded by Barnard as *Macrocallista lilacina* (Lamarck, 1818) [= *Callista spuma* (Röding, 1798)] are referable to *Venerupis dura*.

We believe *Venerupis rufiscensis* to be based merely on coarsely-ribbed examples of *V. dura*. The range of supposed differences between the two is no greater than that found in the present material. Two Recent Angolan shells (N.M. coll.) even appear to combine the ridge number of *V. dura* with the ridge profile of *V. rufiscensis*.

We are following Fischer-Piette & Métivier (1971) in referring this species to *Venerupis* Lamarck, 1818. However, despite the gradually ascending pallial

sinus, its true affinities (as suggested by shape, sculpture, colour and hinge structure) probably lie not with *Venerupis* but with *Paphia* Röding, 1798. Differences between *Paphia*, *Venerupis* and *Tapes* Von Mühlfelt, 1811, are, however, small and possibly artificial. The species at present ranges from southern Morocco to Angola (Nicklès 1950).

Family Petricolidae

Petricola (Claudiconcha) prava sp. nov.

Fig. 17

Type material

Holotype: SAM-K4569.

Paratypes 1-3: 1 right, 2 left valves, NM-A79/T1820.

Paratype 4: right valve, SAM-K4570.

Paratype 5: right valve, SAM-K4571.

Diagnosis

Shell relatively large (40-50 mm), inequivalve, always deformed and irregular; sculptured by fine radial lirae, often only visible posteriorly, and coarse, irregular, non-lamellar growth lines; pallial sinus very deep.

Description

Shape very irregular and always more or less deformed, often somewhat rostrate posteriorly with the ventral margin concave; valves thick and very convex; umbo orthogyrate, strongly curved, varying in position from submedian to less than one-third of distance from anterior end. Sculpture of fine radial lirae, often only visible posteriorly, and coarse, irregular growth lines, sometimes elevated posteriorly, but not lamellar.

Right hinge with two peg-like cardinal teeth, of which the posterior one may be shallowly bisected by a groove. Left hinge with three cardinals of which the anterior is reduced to a small denticle, the central is peg-like, triangular in cross-section, and medially concave below (but not bifid), and the posterior one is an oblique lamella partly fused to the nymph. Nymphs are very large, sometimes massive, more or less projecting and spathulate, separated from valve margin by a deep groove. Pallial sinus free, apically rounded, very deep, extending well below midline.

Dimensions

Holotype: left valve, 49,9 × 37,2 mm;

right valve, 52,0 × 37,4 mm;

breadth of valves together (inflation), 31,3 mm (posterior end chipped).

Paratypes: single left valve, 51,0 × 36,5 mm;

single right valve, 49,3 × 39,9 mm.



Fig. 17. *Petricola* (*Claudiconcha*) *prava* sp. nov. A. Holotype. B. Paratype 4. A (lower), B, C show variation in shell form. (Quarry 1,5 km north of Langebaan.)

Distribution records

Smitswinkelbaai (Saldanha), behind Sea Harvest factory, 6,5–8 m a.s.l.; quarry 1,5 km north of Langebaan, 9,5 m a.s.l. (type locality). Early Pleistocene.

Remarks

The markedly inequivalve shell of *Petricola prava* shows it to be referable to the subgenus *Claudiconcha* Fischer, 1887. Of described members of the taxon, *Petricola japonica* Dunker, 1882, from Japan, *P. quadrasi* (Hidalgo, 1886) from the Philippines and Indonesia, *P. cumingi* Deshayes, 1853, from South Australia, and *P. chinensis* Deshayes, 1853, from China and the Philippines, differ in possessing strong concentric sculpture without radials. On the other hand, while *P. monstrosa* (Gmelin, 1791) from Nicobar and the Ryukyu Islands, and *P. madreporica* (Jousseaume, 1895) from the Red Sea, do show dominant radial lirae as in *P. prava*, in these the lirae are stronger and more uniformly developed, and shell size is markedly smaller. The closest species is probably *P. robusta* Sowerby, 1834, from tropical west America, which is usually regarded as a *Rupellaria*, but has the unequal valves of *Claudiconcha*; this differs from *Petricola prava* in its somewhat weaker radials and much shallower pallial sinus.

The distinctly inequivalve shell and large size distinguish *P. prava* from the three Recent South African species, *Petricola* (*Rupellaria*) *bicolor* Sowerby, 1854, *P. (Petricola) ponsonbyi* Sowerby, 1892, and *P. (P.) divergens* (Gmelin, 1791). The latter two also differ in their divaricate sculpture. *P. bicolor* is the most similar, as not only are some individuals very slightly inequivalve, but a rock-boring morph which occurs in South West Africa is frequently deformed in much the same manner as *P. prava*. However, the stronger radial sculpture and shallower pallial sinus of *P. bicolor*, together with the characters cited above, are diagnostic.

Family Donacidae

Donax sanctuarium sp. nov.

Fig. 18

Type material

Holotype: right valve, SAM-K4572.

Paratypes: 1 right, 1 left valve, NM-A1216/T1826;

2 right, 2 left valves, SAM-K4573.

Diagnosis

Moderately large (40–60 mm); oblong-trigonal, posteriorly truncate, umbonal ridge feeble; smooth, posterior end with concentric ridges, and a series of interstitial radials just behind the umbonal ridge; inner margin smooth. Nymphs very prominent, lateral teeth present, except for the right anterior one, which may be absent.

Description

Oblong-trigonal, length $2,1 \times$ height, umbo approximately one-third distance from posterior end; antero-dorsal margin straight, anterior end well-



Fig. 18. *Donax sanctuarium* sp. nov. A. Holotype. B. Paratype. (Churchhaven.)

rounded, postero-dorsal margin convex, declivous, posterior end sharply rounded, ventral margin gently and evenly curved, ends narrowly gaping, posterior end with a very slight umbonal ridge, but no distinct angle, posterior face moderately truncate. Greater part of shell smooth, except for growth lines, posterior face corrugated by fine, wavy, concentric ridges, with a narrow area adjacent to the umbonal ridge also traversed by interstitial radial riblets; inner ventral margin of valves smooth. Hinge of left valve with two narrow, subequal, divergent cardinals, a low ridge-like anterior lateral tooth situated close to the cardinals, and a rather remote and stronger ridge-like posterior lateral. Hinge of right valve with a somewhat trigonal posterior cardinal, somewhat variable in shape, but always bisected by a shallow groove, occasionally weakly bifurcate; anterior cardinal long, oblique and ridge-like, anterior lateral feeble or absent, posterior lateral strong and elongate, bordered dorsally by a trough. Nymph prominent, variable, but usually large and projecting conspicuously beyond dorsal margin. Pallial sinus extending to midline, lower margin fused with pallial line, not markedly ascending, shape variable, but usually straight dorsally, roundly truncate anteriorly.

Dimensions

Holotype: 46,4 × 22,9 mm.

Paratypes: 59,5 × 28,2 mm;

52,4 × 24,7 mm.

Distribution records

Churchhaven, 1,5 m a.s.l. (N.M., S.A.M.) (type locality).

Remarks

Donax sanctuarium appears to be quite distinct from any other member of the genus. It may perhaps be compared with *D. (Capsella) variegata* (Gmelin, 1791), from the Mediterranean, which, however, is rounded and smooth posteriorly, and has a weaker nymph. *D. haughtoni* Carrington & Kensley, 1969, from the Late Cenozoic of Namaqualand, is a larger, deeper and more ovate species, with a more central umbo and a smooth posterior face. *D. oweni* Hanley, 1843, from West Africa is smaller (25 mm) and has a very curved ventral margin.

D. sanctuarium (whose specific name is a literal translation of the type locality Churchhaven) does not agree with any of the described subgeneric units (cf. Keen 1969) of the genus *Donax*. As the current system of classification is most unsatisfactory, we have not erected a new taxon for its reception.

Family Tellinidae***Gastrana fibrosa* sp. nov.**

Fig. 19

Type material

Holotype: right and left valves (articulated shell), SAM-K4574.

Paratypes: 1 articulated shell, 1 right valve, 2 left valves, NM-A1220/T1830;

2 right valves, 2 left valves, SAM-K4581.

Diagnosis

Large (60–70 mm), very solid, posterior end produced but not rostrate; sculptured medially by radial threads, more or less replaced at each end by lamellose concentric threads. Hinge plate massive, left anterior cardinal projecting and spatulate, not bifid.

Description

Shell very solid, moderately compressed, with a narrow gape at each end. Umbo situated two-fifths of total length from anterior end; anterior end broadly rounded, posterior end somewhat tapering, with a very slight umbonal ridge; between the umbonal ridge and the postero-dorsal margin there is a faint indication of a ridge, visible more as an alteration in the direction of the concentric sculpture than as a prominence; postero-dorsal margin straight or slightly convex, ventral margin evenly convex or with a suggestion of a sinuosity posteriorly.

Sculpture tripartite, with regular thread-like concentric lamellae posteriorly, another weaker series anteriorly, and the median half or two-thirds bearing fine, uneven, radial threads, crossed by growth lines which may render them almost cancellate; in odd individuals the concentric threads may cross the whole surface, although becoming irregular medially.

Hinge complex massive, two cardinal teeth in each valve, no laterals. Right

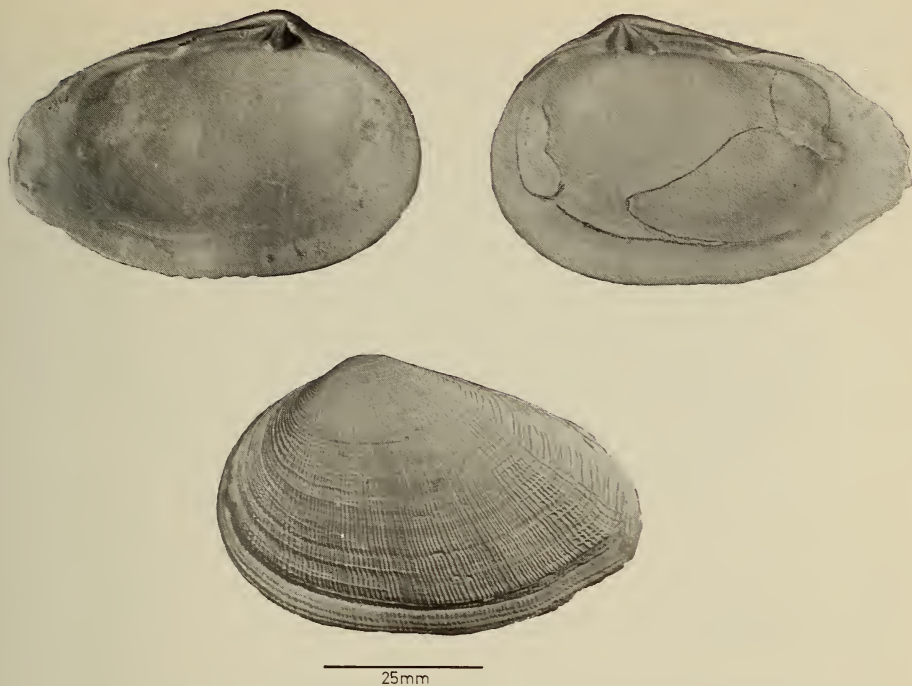


Fig. 19. *Gastrana fibrosa* sp. nov. Holotype. (Naval Academy, Saldanha.)

anterior cardinal almost perpendicular to hinge axis and diverging from posterior cardinal at an angle of 40–45°; both teeth are simple and ridge-like, not, or very slightly, bisected, posterior cardinal longer than anterior one. Left anterior cardinal large and spatulate, projecting conspicuously from hinge plate, tip rounded and simple, with only a trace of a median groove; posterior cardinal a rather low, triangular ridge. Nymphs well developed. Adductor muscle scars and pallial line well impressed, pallial sinus deep, largely confluent with pallial line, end rounded to subacute.

Dimensions

Holotype: 66,5 × 43,5 mm;
total breadth 25,3 mm.

Paratypes: 72,4 × 46,6 mm;
68,8 × 46,0 mm.

Distribution records

Naval Academy, Saldanha (1,7 m a.s.l.) (type locality) and Churchhaven (1,5 m a.s.l.).

Remarks

Gastrana fibrosa is very closely allied to the poorly known *G. multangula* (Gmelin, 1791) (syn. *Tellina polygona* Röding, 1798, non Gmelin, 1791) from

Gambia, and may prove to be only a subspecies of that. Judging by Römer's description and figures (1872: 272, pl. 51 figs 5-7), *G. multangula* differs in possessing a subcentral umbo, very fine interstitial radial lirae, continuous concentric threads which traverse the middle, and a stronger umbonal ridge. Unfortunately details of the shape of the left anterior cardinal are unknown, Römer referring to this merely as 'subfisso', which barely applies to *G. fibrosa*. It should be noted, too, that while Römer's figure of *G. multangula* shows a wholly free pallial sinus, his text contradicts this.

G. fibrosa closely approaches *G. rostrata* Carrington & Kensley, 1969, from the Lower Pleistocene of Namaqualand in size and sculpture, but differs in its non-rostrate posterior end and straight or convex dorsal margin, this being concave in *G. rostrata*; hinge details also differ, notably the characteristic left anterior cardinal, which in *G. rostrata* is short and distinctly bisected, rendering the tip almost bifid.

G. fibrosa differs widely from the remaining two comparable species of *Gastrana*, *G. matadoa* (Gmelin, 1791) (syn. *Tellina abildgaardiana* Spengler, 1798) from South and West Africa, and *G. fragilis* (Linnaeus, 1758) from the Mediterranean, both of which are of Recent occurrence. It differs in its much larger size, greater solidity, in outline, non-bifid left anterior cardinal, and different sculpture, the radial element being well developed and the concentric one irregular or restricted to the ends; in *G. matadoa* and *G. fragilis* the concentric lamellae are well developed over the whole surface, and radial sculpture is reduced to very fine interstitial striae.

Tellina (Eurytellina) madagascariensis Gmelin, 1791

Fig. 20

Tellina madagascariensis Gmelin, 1791: 3237. Römer, 1871: 64, pl. 17 (figs 4-7). Dautzenberg, 1912: 102. Nicklès, 1950: 224, fig. 435. Paes da Franca, 1960: 36.

Tellina rosea (non Spengler, 1798): Haughton, 1932: 37.

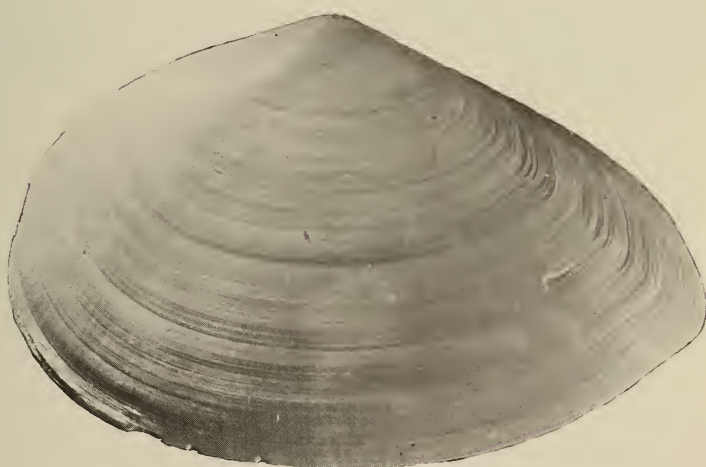
Tellina (Eurytellina) madagascariensis: Boss, 1969: 122, pl. 10 (fig. 3).

Description

Elongate-elliptical, compressed, umbo peaked, slightly anterior to middle, posterior end strongly flexed to right, narrowly gaping; right valve less convex than left; anterior margin broadly rounded, postero-dorsal margin declivous, shallowly concave behind umbo, then straight or slightly convex, posterior end narrowly rounded or feebly truncate, ventral margin evenly curved. External surface with fine growth striae and very faint, scratch-like radial striae; right valve with a low, blunt umbonal ridge, corresponding to a shallow depression in the left valve. Right anterior cardinal tooth simple, posterior one bifid as is the left anterior cardinal; right posterior cardinal thin, ridge-like and simple. Anterior lateral teeth close to cardinals, posterior ones distant, situated at end of nymph; in right valve anterior lateral is strong, posterior one feeble; both left laterals are weak. Nymphs well developed, each with a ridge on its inner surface.



25mm



25mm

Fig. 20. *Tellina* (*Eurytellina*) *madagascariensis* Gmelin, 1791. (Churchhaven.)

Adductor muscle scars well impressed; two faint cruciform scars just below posterior end of pallial line. Pallial sinus not ascending, lower margin wholly confluent with pallial line, extending almost to anterior adductor.

Dimensions

69,5 × 41,3 × 17,3 mm, 66,8 × 44 × 19 mm.

Distribution records

Redhouse (S.A.M.); Deal Party, 12–23,8 m (N.M.); Cradock, 45,7 m (N.M.); Klein Brak River (Boss 1969); Churchhaven, 1,5 m a.s.l. (S.A.M.); Geelbek (S.A.M.); Verlorevlei, 4 m a.s.l. (S.A.M.); Cape Cross, S.W.A. (S.A.M.).

Boss (1969) showed that previous Recent records of *Tellina madagascariensis* from South Africa were based on *Tellina alfredensis* Bartsch, 1915. He did, however, record the true West African *T. madagascariensis* from a raised beach at the 'Klein' (i.e. Klein Brak) River mouth. During the Pleistocene this species was in fact abundant along much of the south and west coast of the Cape, and in South West Africa. After its extinction along the South African coast, no doubt due to climatic change, *T. madagascariensis* was replaced by the endemic *T. alfredensis*.

Tellina madagascariensis occurs living today from Baia dos Tigres (17°S) to Sao Thome (0°) (Boss 1969).

Macoma (Heteromacoma) tricostata (Römer, 1872)

Fig. 21

Tellina tricostata Römer, 1872: 235, pl. 49 (figs 10–12).

Description

Both valves rather inflated, right valve slightly deeper than left; outline ovate-trigonal, umbones high, usually situated two-fifths of length from anterior end, but sometimes nearly median; posterior end moderately rostrate, tapering rapidly, end roundly truncate; postero-dorsal margin straight and evenly declivous, rest of margin evenly rounded. Shell slightly flexed to right posteriorly, right valve with a very weak umbonal ridge, followed by 1–2 very feeble ridges, left one with a depressed umbonal ray, followed by a weak ridge near the dorsal margin; surface otherwise sculptured by growth lines only. Pallial sinus very deep, almost reaching anterior adductor scar, non-ascending, lower margin completely fused with pallial line, upper margin feebly bilobate; sinus larger in right valve than in left. Hinge of each valve with two cardinal teeth, of which the posterior ones form thin, feeble ridges, the anterior ones being erect and more peg-like, simple in the right, apically bifurcate in the left. Nymphs large, thick, bordered by deep ligamental furrows.

Dimensions

53,6 × 43,1 × 23,0 mm; 46 × 36,3 × 18,7 mm; 47,2 × 38,3 × 19 mm; 41,3 × 35,0 mm.

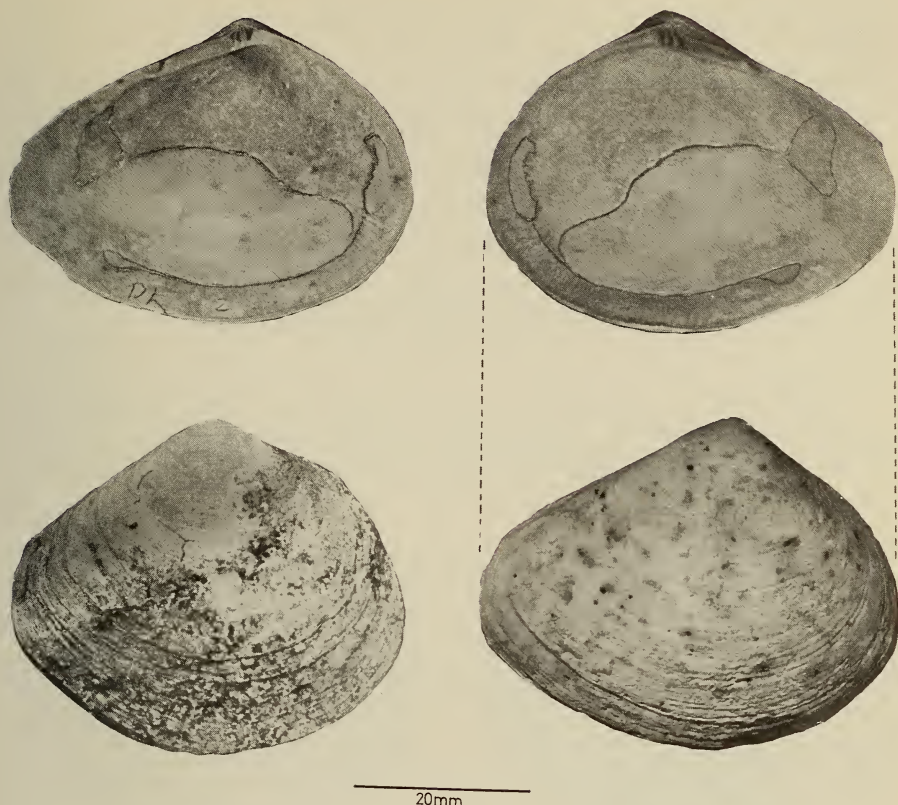


Fig. 21. *Macoma* (*Heteromacoma*) *tricostata* (Römer, 1872). Note variation in form. (Verlorevlei.)

Distribution records

Verlorevlei, 4 m a.s.l. (S.A.M.).

Remarks

Specimens from Verlorevlei agree well with Recent valves from Angola, except in being thicker. While these specimens resemble Nicklès's figure (1950: fig. 432) of the exterior of *Tellina nymphalis* Lamarck, 1818, they disagree with Römer's excellent figures (1872: pl. 45, figs 1-4) of the same species. These show a non-rostrate shell with more extensive, rounded pallial sinus. On the other hand these specimens agree closely with Römer's *T. tricostata* from Gabon. There is, however, some variation in shape in the present material, and one specimen somewhat approaches Römer's concept of *T. nymphalis* in its moderately reduced posterior end. Not only does the relationship between the two require

investigation, but re-examination of the holotype of *T. nymphalis* is desirable in order to confirm Römer's interpretation. For the present it is advisable to use the name *tricostata*, which undoubtedly applies to the present material.

The only comparable South African *Macoma* is *M. (Macoma) litoralis* (Krauss, 1848), a smaller, more compressed species with a lower umbo, stronger hinge-teeth and inconspicuous nymphs.

Leporimetis (Leporimetis) hanleyi (Dunker, 1853)

Fig. 22

Tellina hanleyi Dunker, 1853: 53, pl. 10 (figs 4–6). Römer, 1871: pl. 14 (figs 7–9); 1872: 214. *Apolymetis orbicularis* (partim non Sowerby); Barnard, 1964: 549.

Apolymetis papyracea (non Gmelin, 1791); Kilburn in Davies, 1972: 252.

Description

Ovate, with peaked umbones situated slightly posterior to middle; shell flexed to the right and narrowly gaping posteriorly; antero-dorsal margin gently convex, anterior end strongly rounded, postero-dorsal margin straight or slightly

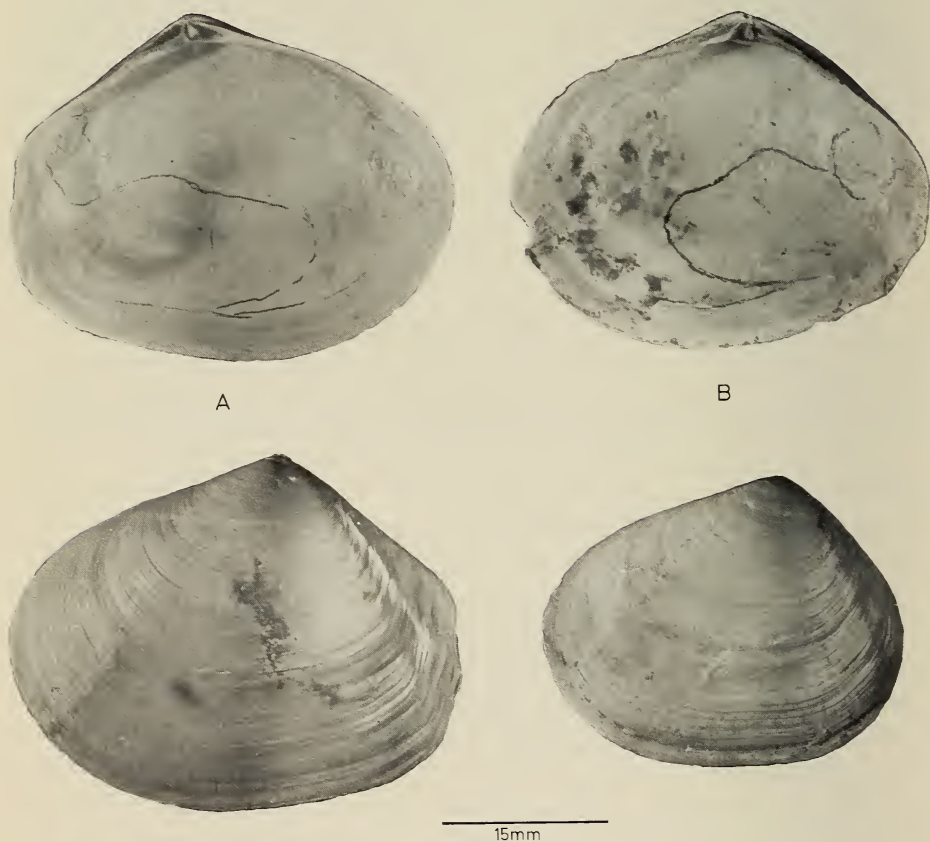


Fig. 22. *Leporimetis (Leporimetis) hanleyi* (Dunker, 1853). (A. Knysna. B. Redhouse.)

convex, fairly steeply descending, posterior margin truncate to broadly rounded, often showing a weak double sinuosity; ventral margin evenly curved, not sinuated. Sculptured by fine growth lines, becoming coarse posteriorly; umbonal ridge very feeble, often not visible in right valve, in left valve bordered behind by a shallow trough, followed by a second feeble ridge. Hinge in each valve with two ridge-like cardinals, of which the anterior ones are the stronger. Nymphs well developed, moderately impressed into hinge-plate. Pallial sinus deep, extending almost to anterior adductor scar, lower margin largely free from pallial line, upper margin shallowly concave, end rounded to moderately truncate.

Dimensions

41,8 × 31,8 mm, 44,7 × 35,0 mm, 39,0 × 30,5 × 14,4 mm (complete example).

Distribution records

Cenozoic: Redhouse, 7,2 m a.s.l. (N.M.); Knysna, 4,6 m a.s.l. (S.A.M.); Sedgfield, 5 m a.s.l. (S.A.M.); Klein Brak River, 3,3 m a.s.l. (S.A.M.).

Remarks

Pleistocene specimens agree well with Römer's detailed description and figures of *Tellina hanleyi* from Luanda (the original description is not available to us). While South African examples are rarely as rounded posteriorly as in these figures there is much variation in this respect, and one example from Redhouse is decidedly curved behind. The species does not appear to have been discussed by recent authors.

The only comparable species is the Recent West African *Leporimetis* (*Florimetis*) *papyracea* (Gmelin, 1791), which differs in its more elevated, subcentral umbones, markedly more inflated valves, and distinct umbonal ridge, median flexure and postero-ventral sinuosity. Although French workers commonly utilize the name '*lacunosa* Schröter, 1788' for *L. papyracea*, that *nomen* was proposed in a non-binomial work, and was not validated until 1817 (by Dillwyn).

The fossil material recorded by Barnard (1964) as *Apolymetis orbicularis* is actually *Leporimetis hanleyi*. The Recent *Leporimetis* (*Florimetis*) *orbicularis* (Sowerby, 1889) from the False Bay-Port Alfred area is a strongly inflated, suborbicular species with a well-developed umbonal ridge, and there are also differences in details of the cardinal complex.

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